

Customer training workshop: Low-Power_Wakeup_from_RTC_Alarm for KIT_T2G-B-H_EVK

TRAVEO™ T2G CYT4BF series Microcontroller Training
V1.0.1 2023-03



Please read the [Important notice and warnings](#) at the end of this document

Scope of work

- › This code example demonstrates how to enter the DeepSleep and Hibernate mode, and wake up using the RTC alarm. This multicore application has the main function running on the CM7_0 core.

- › Device
 - The TRAVEO™ T2G CYT4BFBCH device is used in this code example.

- › Board
 - The TRAVEO™ T2G KIT_T2G-B-H_EVK board is used for testing.

Introduction

› **MCU supports the following power modes:**

- Active: All peripherals are available
- Low-Power Active (LPACTIVE) profile: Low-power profile of Active mode where all peripherals including the CPU are available, but with limited capability
- Sleep: all peripherals except the CPU are available
- Low-Power Sleep (LPSLEEP) profile: Low-power profile of Sleep mode where all peripherals except the CPU are available, but with limited capability
- DeepSleep: Only low-frequency peripherals are available
- Hibernate: The device and I/O states are frozen and the device resets on wakeup
- XRES: The device enters this state when the XRES_L pin is asserted

Introduction (contd.)

› **Power modes have the following features:**

- Software can use power modes to optimize power consumption in an application.
- Low-power DeepSleep mode with support for multiple wakeup sources and configurable amount of SRAM retention.
- Ultra-low-power Hibernate mode with wakeup from I/O and timer alarms

The power consumption in different power modes is controlled by using the following methods:

- Enable and disable the clocks to peripherals
- Powering ON/OFF clock sources
- Powering ON/OFF peripherals and parts inside the device

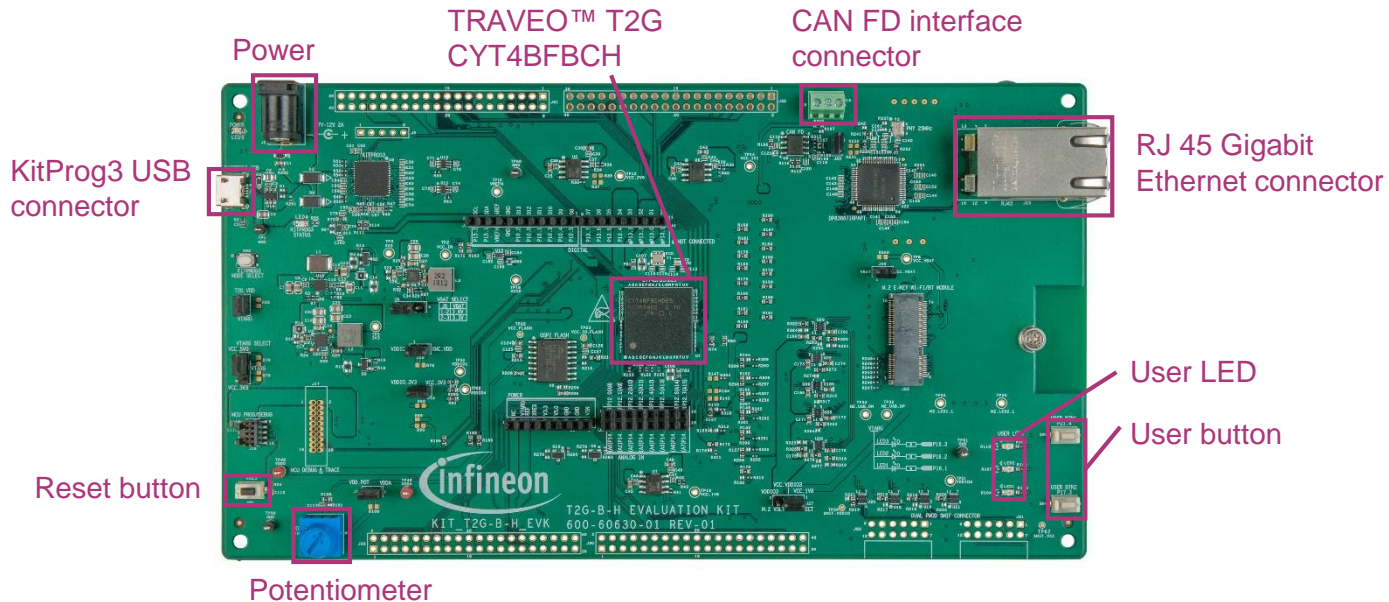
Introduction (contd.)

› **RTC has the following features:**

- Fully-featured RTC
- Year/Month/Date, Day-of-Week, Hour : Minute : Second fields (All fields Integer)
- Supports both 12-hour and 24-hour formats
- Automatic leap year correction
- Configurable alarm function
- Alarm on Month/Date, Day-of-Week, Hour : Minute : Second fields
- Two independent alarms
- Calibration for 32768-Hz WCO and 4 MHz to 8 MHz LPECO
- Calibration waveform output
- Supports 512 Hz, 1 Hz, and 2 Hz
- Backup registers

Hardware setup

- › This code example has been developed for the KIT-T2G-B-H-EVK board.
- › Connect your PC to the board using the provided USB cable through the KitProg3 USB connector.



Implementation

This code example demonstrates how to enter the DeepSleep and Hibernate mode, and use RTC to generate an RTC alarm to wake up the MCU from DeepSleep and Hibernate mode. The main loop checks if the user button was pressed and duration of the press.

Follow these steps to configure this code example:

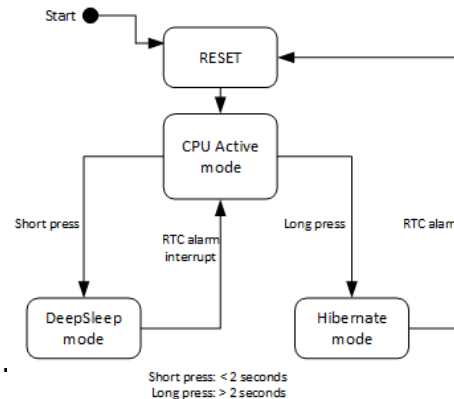
- > CM0P core enables CM7_0 core and CM7_1 core.
- > CM0P core and CM7_1 core go to DeepSleep.
- > Run the Power modes and RTC control on the CM7_0 core.

CM0P core enables CM7_0 core and CM7_1 core

- > Enable CM7_0 core and CM7_1 core by calling [Cy_SysEnableCM7\(\)](#) function.

CM0P core and CM7_1 core goes to DeepSleep

- > Both CM0P and CM7_1 core go to DeepSleep by calling [Cy_SysPm_CpuEnterDeepSleep\(\)](#).



Implementation (contd.)

Running the power modes and RTC control on the CM7_0 core

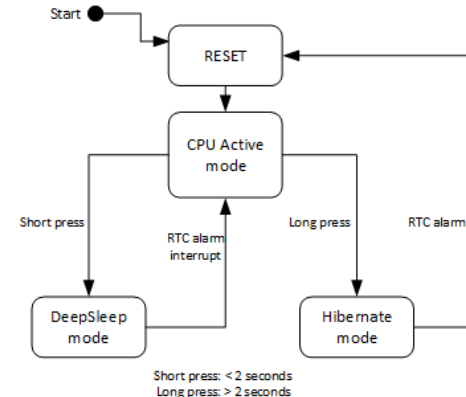
- › Initialize the UART block for display messages on the terminal.
 - Call the [cy_retarget_io_init\(\)](#) function to use UART.
 - Initialize P13.1 as UART TX, P13.0 as UART RX (these pins are connected to KitProg3 COM port).
 - The serial port parameters changes to 8N1 and 115200 baud.
- › Initialize the user button.
 - Call the [cyhal_gpio_init\(\)](#) function to initialize the user button P21.4.
- › Register power management callbacks.
 - Call the [cyhal_syspm_init\(\)](#) function to initialize system power management that is needed for future operations.
- › Initialize RTC.
 - Call the [cyhal_rtc_init\(\)](#) function to initialize RTC.
 - Call the [cy_SysLib_GetResetReason\(\)](#) function to check the reset reason and call the [cyhal_rtc_write_direct\(\)](#) function to set date/time to RTC if reset reason is not **CY_SYSLIB_RESET_HIB_WAKEUP**.
 - Call the [cyhal_rtc_enable_event\(\)](#) function to enable RTC to wake-up the MCU.

Implementation (contd.)

Running the power modes and RTC control on the CM7_0 core

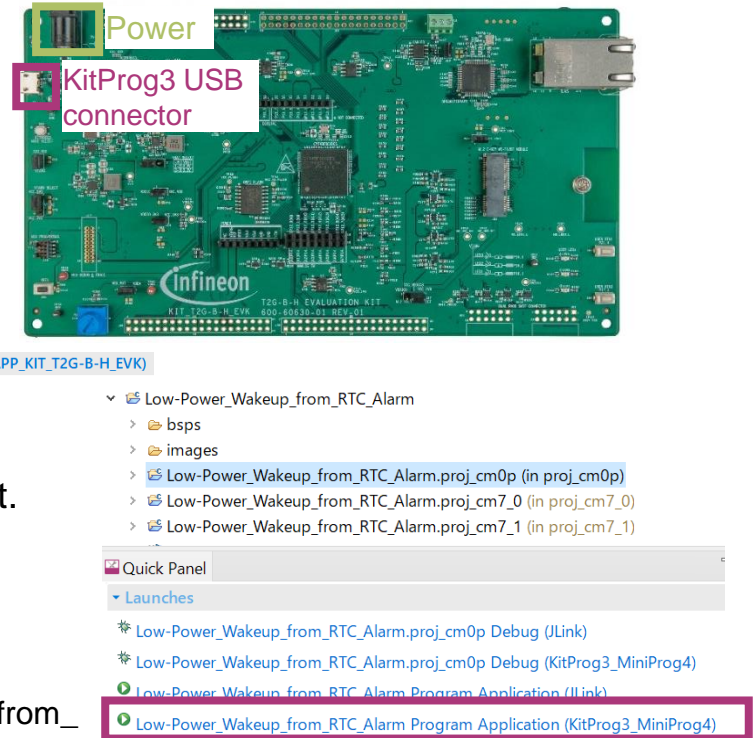
- › Go to DeepSleep mode or Hibernate mode by pressing the user button
 - The user button state is read by [cyhal_gpio_read\(\)](#) in the [get_switch_event\(\)](#) function.
 - Before going to each mode, set RTC alarm to 10 sec later to wakeup by calling [cyhal_rtc_set_alarm_by_seconds\(\)](#) in the [set_rtc_alarm_date_time\(\)](#) function
 - Call the [cyhal_syspm_deepsleep\(\)](#) function to set CPU to DeepSleep mode
 - Call the [cyhal_syspm_hibernate\(\)](#) function to set the system mode to Hibernate
- › Wakeup from DeepSleep mode/Hibernate mode
 - RTC alarm will wake up the device after 10 seconds.

Short Press : ~2 seconds	DeepSleep mode
Long Press : >2 seconds	Hibernate mode



Compiling and programming

1. Connect to power and USB cable
2. Use Eclipse IDE for ModusToolbox™ software for compiling and programming
3. Compile
 - a) Select the target application project in the Project Explorer.
 - b) In the Quick Panel, scroll down, and click “Build Application” in Low-Power_Wakeup_from_RTC_Alarm(APP_KIT-T2G-B-H-EVK)
4. Open a terminal program and select the KitProg3 COM port. Set the serial port parameters to 8N1 and 115200 baud.
5. Programming
 - a) Select the target application project in the Project Explorer
 - b) In the Quick Panel, scroll down, and click “Low-Power_Wakeup_from_RTC_Alarm Program Application (KitProg3_MiniProg4)¹” under Launches



¹ Multicore is used in this code example. Thus it needs to program 3 times by each core.

Run and test

1. After successful programming, the terminal should display the following message.

```

COM14 - Tera Term VT
File Edit Setup Control Window Help
*****
HAL: Low power wakeup from RTC alarm
*****
Short press 'SW2' key to DeepSleep mode, long press 'SW2' key to Hibernate mode.

16:17:00 2022-02-28: Current date and time.
16:17:02 2022-02-28: Go to DeepSleep mode
16:17:02 2022-02-28: RTC alarm will be generated after 10 seconds
16:17:12 2022-02-28: Wakeup from DeepSleep mode
16:17:17 2022-02-28: Go to Hibernate mode
16:17:17 2022-02-28: RTC alarm will be generated after 10 seconds
    
```

2. Short press the **SW2** key to go to DeepSleep mode or long press the **SW2** key to go to Hibernate mode. Observe the results in the terminal window.
3. After long pressing the **SW2** key, Hibernate mode wakes up the terminal application and displays the following message.

```

*****
HAL: Low power wakeup from RTC alarm
*****
Short press 'SW2' key to DeepSleep mode, long press 'SW2' key to Hibernate mode.

16:17:27 2022-02-28: Wakeup from the Hibernate mode
16:17:27 2022-02-28: Current date and time.
    
```



References

Datasheet

- › [CYT4BF datasheet 32-bit Arm® Cortex®-M7 microcontroller TRAVEO™ T2G family](#)

Architecture technical reference manual

- › [TRAVEO™ T2G automotive body controller high family architecture technical reference manual](#)

Registers technical reference manual

- › [TRAVEO™ T2G automotive body controller high registers technical reference manual](#)

PDL/HAL

- › [PDL](#)

- › [HAL](#)

Training

- › [TRAVEO™ T2G Training](#)

Revision History

Revision	ECN	Submission Date	Description of Change
**	7782616	2022/07/06	Initial release
*A	7876702	2023/03/01	Changed CySysEnableCM7 to Cy_SysEnableCM7 in "Implementation" Removed Cy_SysPm_CpuSleepOnExit() in "Implementation" Changed figures in "Compiling and programming"

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Edition 2023-03

**Published by
Infineon Technologies AG
81726 Munich, Germany**

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**Document reference
002-35581 Rev. *A**

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